CALORIES BURNT PREDICTION USING MACHINE LEARNING ALGORITHM

Machine Learning Project Report

Submitted to the faculty of Engineering of
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY KAKINADA, KAKINADA

In partial fulfillment of requirements for the award of Degree of

BACHELOR OF TECHNOLOGY
IN
ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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CERTIFICATE

This is to certify that the project report entitled **"Calories Burnt prediction Using Machine Learning Algorithm"** is a bonafide record of work carried out by **Kanubaddi Jahnavi (22481A5439), Kodali Jyoni (22481A5447), Karnati Murali (23485A5408) and Kandala Subramanyam(22481A5437)** Under the guidance and supervision of **Dr. K. Ashok Reddy** in partial fulfillment of the requirements for the award of degree of Bachelor of Technology in Artificial Intelligence And Data Science of Jawaharlal Nehru Technological University Kakinada, Kakinada during the academic year 2024-2025.

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ABSTRACT

In this growing technological era, People are less aware of their health and mental stability. Due to lack of time, they intake more junk food than healthy options, which leads to an increase in the total calorie rate in their body. which is a major cause of obesity a calorie is the rate of energy stored and energy expenditure.

People nowadays want quick solutions to every problem they want to exercise less and get more results, so to check the level of improvement and the burnt calories level after exercise in the human body we came up with this machine Learning System which takes some attributes as input and gives approximate calories burnt value which will motivate people to do more exercise and will show their daily growth

The project is nourished with more than 15,000 data and its MAE (Mean Absolute error) is 1.48 which will enhance over time for better Results. By analyzing features such as manufacturer or brand, year of production, interior finish, fuel type, engine volume, gear box type and airbags, a predictive model has been developed using the K Nearest Neighbors Algorithm. The model was rigorously evaluated using standard metrics like Adjusted R-squared value and mean-squared error.

The achieved performance shows the accuracy in predictions. The proposed system once trained with real-time data of calories and features can efficiently predict burnt calories. The K Nearest Neighbors algorithm was chosen for obtaining higher accurate results. After training and testing, the model displayed strong predictive power, demonstrating its suitability for integration into car markets.

Such a system can help predicting the calories in an effective way without any human interference. The project includes comprehensive stages of data preprocessing, feature selection, model training, and evaluation. The final model demonstrated high accuracy and reliability in predicting the calories. Through the data preprocessing, feature engineering, and model evaluation, a robust predictive system was developed.

The model was assessed using various performance metrics, indicating high reliability and generalizability. This work contributes to ongoing research in gender, weight, height, duration, body temperature and heart beat and showcases the potential of machine learning in building an effective calories burnt prediction system that can support calories analysis.

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CHAPTER 1 INTRODUCTION

1.1 INTRODUCTION

The amount of calories burnt depends on internal and external factors, it is subjective and different for everyone depending on their height, weight, and fitness level Generally, people relate calories to weight or food reduction however it is a quantity of heat energy. From a human perspective, the number of calories is the amount of energy required to carry out a task. Different items have different calorie values related to them.

As a human body performs some extensive activity or workout the body temperature and heart rate start rising which leads to the production of heat energy in the body. Which ultimately causes calories to burn. To show the same we take some input parameters such as age, gender, height, and weight and apply different regression algorithms such as linear regression, XG Boost regression, AdaBoost regression, SVR, Decision tree regression, and Random forest regression over the data to get the best and optimal results

.

This project focuses on building a machine learning model capable of predicting calories based on key attributes. By training the model on a dataset of used height, weight, age, gender, body temperature and heart rate it learns to recognize patterns and relationships between the input features and the calories. The goal is to develop a robust and reliable system that can assist both consumers and to maintain calories and maintain fitness.

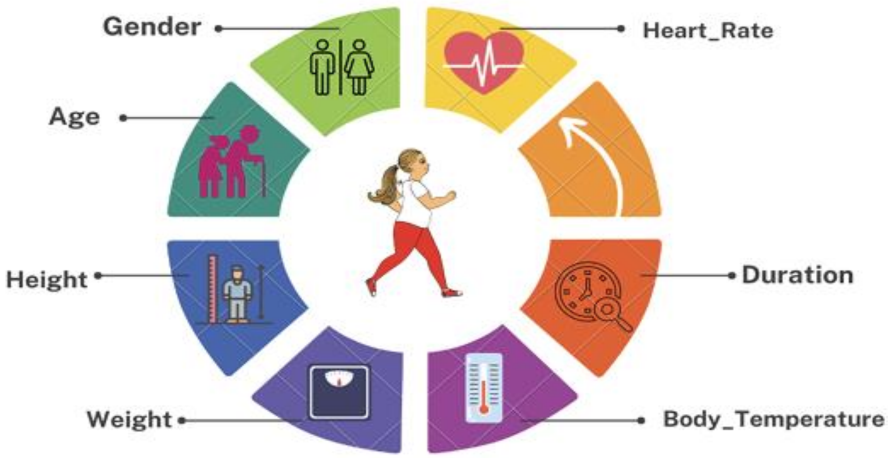


Fig-1 Attributes of calories burnt prediction

1.2 PROBLEM STATEMENT

Predicting the calories to maintaining a healthy lifestyle requires understanding energy expenditure, yet individuals struggle to estimate the calories they burn during daily activities or exercise. Traditional methods, such as manual calculations or fitness trackers, may be inaccurate due to variations in age, weight, heart rate, and activity intensity. The objective is to develop a predictive model that accurately estimates calorie expenditure based on key factors like personal attributes, exercise type, and duration. This model can help users make informed decisions about nutrition, fitness, and overall health..

1.3 EXISTING SYSTEM

1.Werable Devices – Apple Watch

- Use data like heart rate, steps, accelerometer data, skin temperature, and GPS.
- Combine biometric inputs (age, weight, height, gender) with activity data.
- Proprietary algorithms estimate calories burned based on activity type and duration..

2. Mobile Fitness Apps - MyFitnessPal

- Use manual inputs (type of workout, time, intensity).
- Some integrate with wearables for better accuracy.
- Calories Burned=Duration (min)×MET value×Weight (kg)÷60

3. Gym Equipment (Treadmills, Bikes, Rowers)

- Basic calculation using time, speed, resistance level.
- Sometimes accept weight/age input for more accuracy
- Calories Burned=Duration (min)×MET value×Weight (kg)÷60

1.4 PROPOSED SYSTEM

The system aims to estimate the number of calories burnt based on user activity, physiological data, and environmental factors. and proposed system for predicting calories burnt is an exciting challenge! A well-structured system could help users track their fitness goals more accurately. Here's a framework for such a system

The proposed system uses calories-prediction dataset consisting of information of several values like age, gender, height, weight, body temperature, heart rate .The objective is to calculate the how many calories burnt by understanding the underlying patterns of the duration.

Key Components of the Proposed System:

1. Data Collection:
    - Calories burnt and feature selection from the dataset

2. Data Preparation or Preprocessing:
    - Handling missing values, Duplicate values, null values and outliers.
    - Label encoding for categorical variables.
    - Feature scaling using Standard Scaler for consistent input ranges.
    - Feature Selection for identifying significant factors using correlation and other graphical mechanisms.
3. Model Development:
    - Split the data into testing and training data for calculating accuracy of models.
    - Developed different Machine Learning models such as Linear Regression, XGBoost Regression, Decision Tree Regressor, Random Forest Regressor and Support Vector Machine.
4. Performance Evaluation:
    - Calculated Adjusted R-Squared Factor value and Mean Squared Error of each model.
    - Model with highest R-Squared Adjustment value and least Mean Squared Error is considered and choosen as the best model or fit for the data.(Here XGBoost).
5. Model Deployment:
    - Developed a Flask API for real-time prediction.
    - Deployed the XGBoost Regressor model in local machine for checking the working and performance of system.

1.5 ADVANTAGES

1.Higher Accuracy:

Using XGBoost Regressor produces the highest Adjusted R-Squared value means that it best suits or fits the data from the dataset.

2.Reduces Overfitting:

By using the linear and XGBoost Regressor, the model reduces overfitting on the data.

3.Robust to Noisy and Missing Data:

The algorithm is robust to noise and can handle missing values, making it suitable for real-world market analysis of calories data that may be incomplete or inconsistent.

4. Feature Selection:

Features are appropriately selected using correlation approach with the prediction of calories.

5.Scalability:

Model performs well on large datasets with many features too.

6.Disciplined Procedure:

System was developed by following all the steps in a sequential way as :

Data Handling → Feature Selection→ Model Development → Evaluation → Deployment.

1.6 DISADVANTAGES

There are some limitations to the developed system as follows:

1.No Spatial Feature Integration:

The dataset lacks geographical features like city name or location, which sometimes play key role in deciding the prices of the cars.

2. Low Scalability:

Although a Flask API and local machine deployment were made, the system hasn't been well designed for large-scale deployment or cloud-based processing, which may be necessary for operational use.

3.Computational Complexity:

As dataset size or features increases, Choosing XGBoost as model for prediction results in more computational complexity.

4.Choosing the Optimal Value of K:

Selecting the optimal value of k is always challenging as it depends on the data and influences the model's performance too.

CHAPTER 2 REQUIREMENT ANALYSIS

2.1 FUNCTIONAL REQUIREMENTS

The functional requirements define the core functionalities that the system must perform to achieve the goal of predicting calories of user. These requirements ensure that the system operates efficiently and accurately using machine learning techniques, particularly the XGBoost Regressor.

1. **Data Requirements:**

Historical data of predicting calories is required i.e., we need to import calories data in structured formats such as csv, xlsx, etc for model development.

2. **Model Requirements:**

Data Preprocessing modules are needed to handle missing values, null values, outliers and categorical values(such as label encoders).

Feature Engineering and Transformation modules are needed.

Machine Learning Algorithms Module such as XGBoost,SVM, Linear Regression,etc needed.

Model Evaluation metrics such as Mean Squared Error and R-Squared Adjustment Values are needed.

3. **Deployment Requirements:**

A web Application or an API is needed to deploy the developed system.

A user friendly interface needed to be created to input user details and predict amount of calories.

Regular update to the developed model is needed for maintaining accuracy.

2.2 NON – FUNCTIONAL REQUIREMENTS

Non-functional requirements define the overall qualities and constraints of the system that influence user experience, performance, and maintainability. These requirements ensure that the system operates reliably and efficiently, even under various conditions.

1. **Performance Requirements:**

Ensure that the model provides better accurate predictions.

Model must be capable of responding within short time such as less than or equal to 2 seconds.

Maintaining minimum scalability of the API or model is required.

System must be able to maintain a good throughput i.e., good count of requests/minute.

2. **Security Requirements:**

Any important information related to model or data must be kept secure so that the model is not collapsed by any evil parties resulting wrong outputs.

Access to definite parties must be accessed based on previliges.

3. **Reliability Requirements:**

The system should perform consistently and produce accurate predictions when provided with valid input data. It should handle unexpected input gracefully and avoid crashing.

4. **Usability Requirements:**

UI must be simple, clear, easy and intuitive for users with different levels of expertise.

5. **Maintainability Requirements:**

The system should be modular, allowing for easy updates, such as re-training the model with new data or replacing the algorithm. Code should be well-documented for future enhancements.

2.3 SOFTWARE REQUIREMENTS

The following software components are necessary to develop, run, and evaluate the machine learning model for predicting car prices:

1.Programming Language & Environment Language: Python 3.7 or above.

IDE: Jupyter Notebook for development and testing, Alternatively: Visual Studio Code or PyCharm.

2.Libraries and Frameworks

Data Analysis: pandas, numpy – Data Manipulation.

Visualization: matplotlib, seaborn – Plots and Graphs.

Machine Learning: scikit-learn – Model Building (XGBoost, Linear Regression, Decision Tree Regression, SVM, Label Encoder, Standard Scaler, etc).

Web Framework: Flask – For Creating Restful APIs.

pickle – A module to save the models i.e., storing sequence formats or patterns.

3.Platforms and Systems

Operating System: Cross-platform (Windows, Linux, macOS).

Browser: For accessing local Flask server endpoints.

CHAPTER 3 DESIGN

3.1 SYSTEM ARCHITECTURE

The system architecture for the calories prediction using Machine Learning Algorithms project consists of multiple interconnected components that handle data processing, model training, evaluation, and prediction. Each layer plays a crucial role in identifying underlying patterns associated with the variable of calories.

1. **Data Source Layer-**

Inputs: Users data (CSV, Excel, database, or API)

Details: This includes essential fields such as calories, gender, age, height, weight, body temperature, heart rate and duration:

Serves as the foundation for analysis and model training.

2. **Data Preprocessing Module-** Tasks:

Handles missing values, null values, duplicates in the data and outliers.

Converts the large data into smaller ranges by scaling the data.

Purpose: Ensures the data is in a usable format for machine learning.

3. **Feature Engineering Module-**

Tasks:

Selects most significant features based on correlation or importance Purpose:

Enhances model accuracy and performance.

4. **Data Splitting Module-** Tasks:

Split the entire data into training data and testing data in the ratio 7:3.

Purpose: To keep some values unseen by the model that could be used to assess the accuracy of the model.

5. **Machine Learning Model Module-**

Algorithms Used: Linear Regression, Decision Tree Regression, XGBoost Regression, Support Vector Machine

Tasks:

Trains the model using processed and engineered data.

Purpose: Learns from historic training data to predict future prices.

6. **Model Evaluation Module-** Tasks:

Tests model performance using metrics like R^2 and MSE.

Purpose: Validates the model's accuracy before deployment.

7. **Prediction Module-**

Input: Test Data

Output: Predicted burnt calories of user.

Task: Applies the trained model to unseen input features.

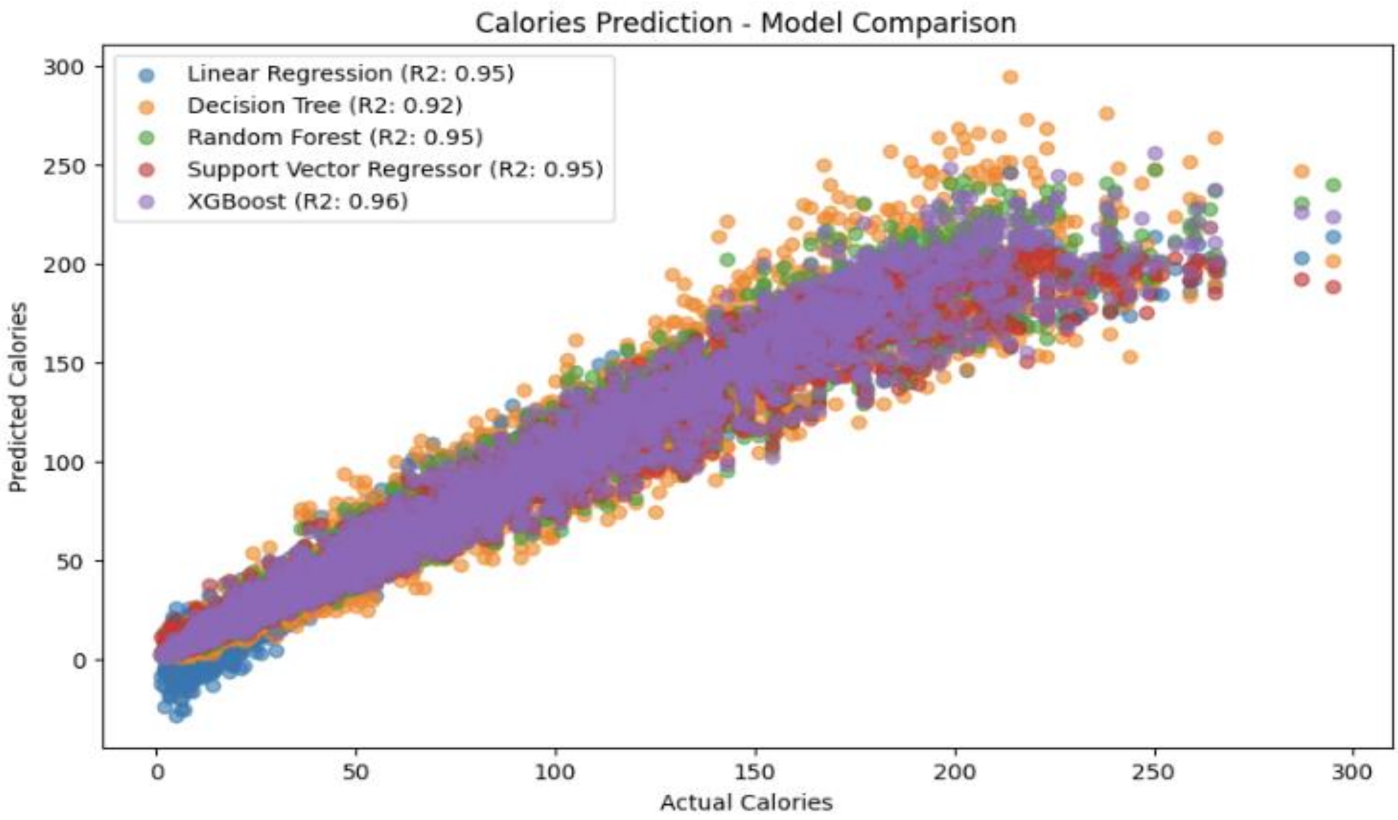
8. Output/User Interface- Tasks:

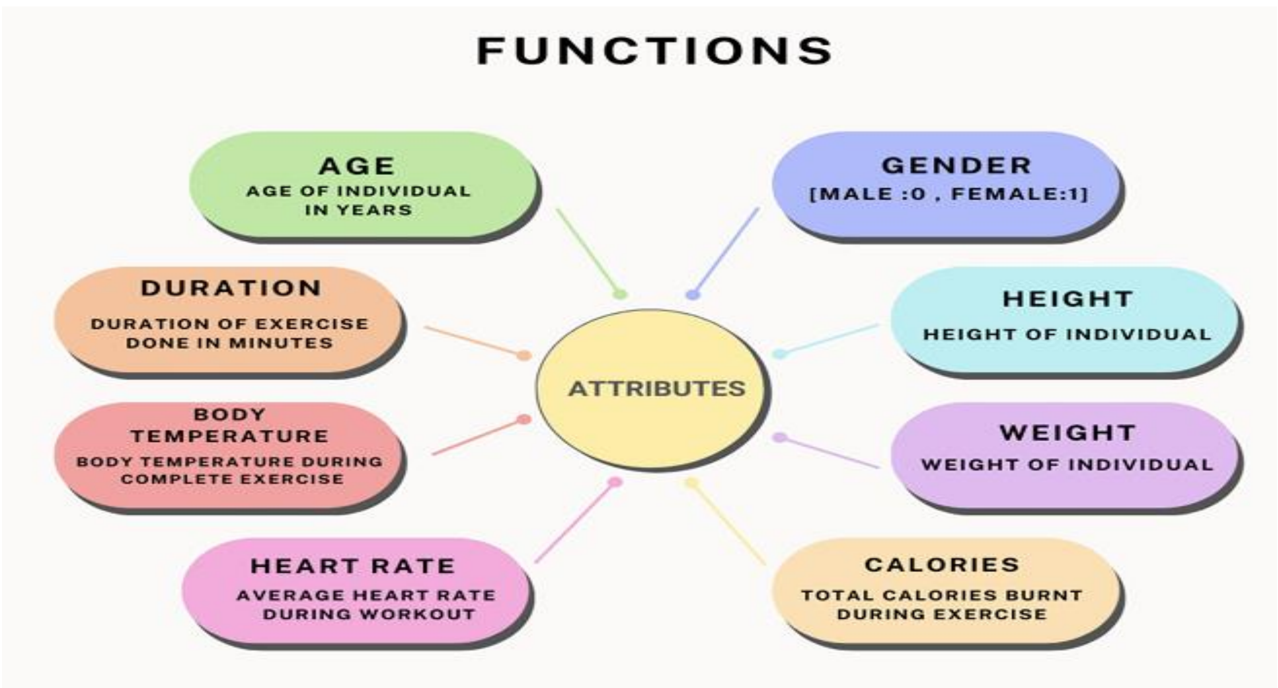
Allows users to input features of the user.

Displays predicted burnt calories using the best fitted model. Tools:

Flask(model connectivity) and HTML(Front-end UI Page) Purpose:

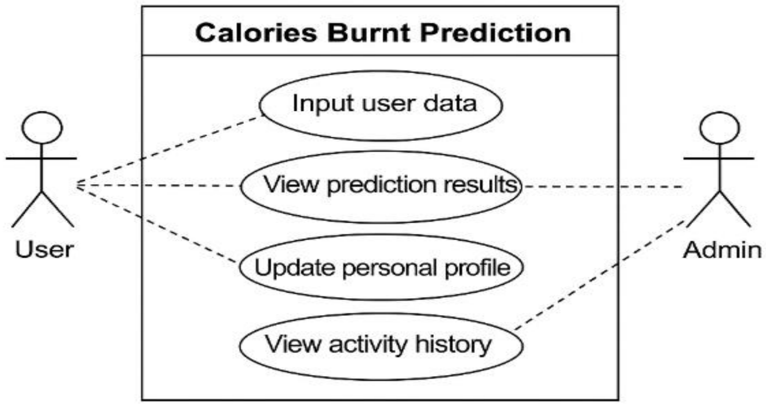
Enhances usability and user interaction with the system.





3.2 UML DIAGRAMS

3.2.1 USECASE DIAGRAM



The use case diagram represents how users and administrators interact with the Calories Burnt Prediction System. It identifies the major functionalities (use cases) and the actors involved in each action, helping to understand the system's behaviour from an external perspective. Actors:

1. User o An individual who wants to predict the burnt amount of calories.
   - o Interacts with the system by entering user details and viewing predicted calories.
2. Admin o A system administrator who manages the system operations. o Responsible for maintaining the dataset, training the XGBoost model, and evaluating model performance.

Use Cases:

- Input user data (age, weight, activity type, duration, etc.)
- View prediction results
- Update personal profile
- View activity history
- Train prediction model (Admin)
- View analytics (Admin)

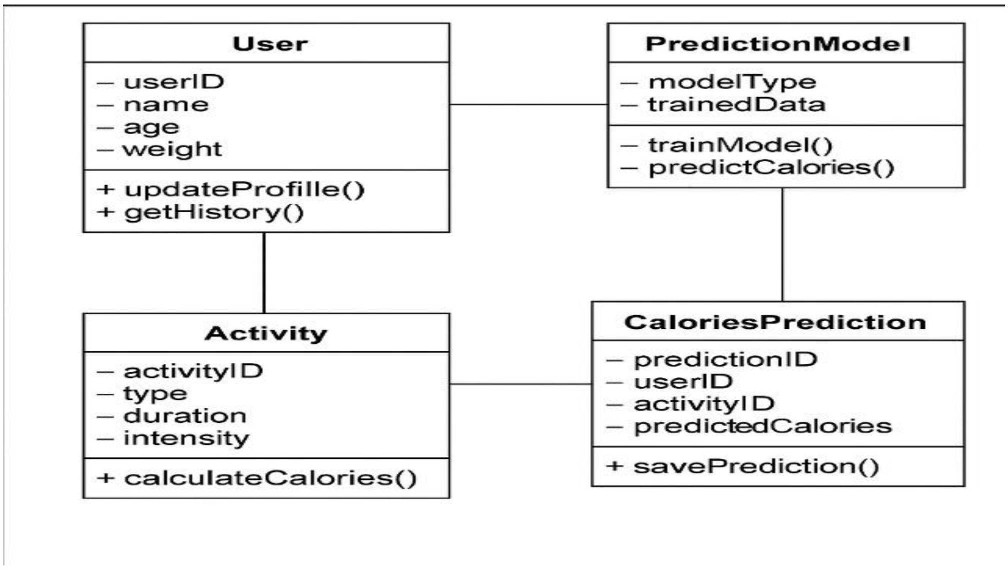
3.2.2 CLASS DIAGRAM

Purpose: Describes the structure of the system with classes and their relationships.

Key Classes:

- User
  - Attributes: userID, name, age, weight, height
  - Methods: updateProfile(), getHistory()

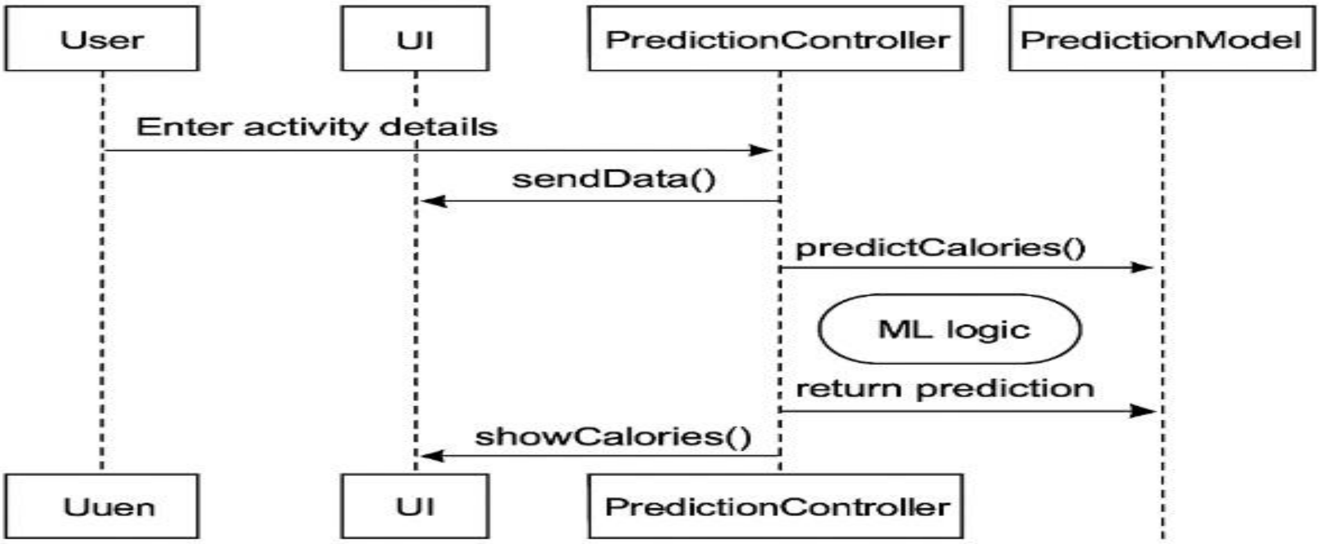
- Activity
    - Attributes: activityID, type, duration, intensity
    - Methods: calculateCalories()
- PredictionModel
    - Attributes: modelType, trainedData
    - Methods: trainModel(), predictCalories()
- CaloriesPrediction
    - Attributes: predictionID, userID, activityID, predictedCalories
    - Methods: savePrediction()



3.2.3 SEQUENCE DIAGRAM

The sequence diagram illustrates the interaction between the user and system components during car price prediction. The User inputs car details via the UI, which forwards them to the Prediction Service. The service calls the Data Preprocessor to clean and transform the data, then sends the processed data to the KNN Model for prediction. The predicted price is returned to the User through the UI. In the backend, the Admin can trigger model training and evaluation using updated datasets. This ensures accurate predictions and continuous system improvement.

The diagram highlights the sequential flow of data and operations, supporting real-time, automated price estimation.

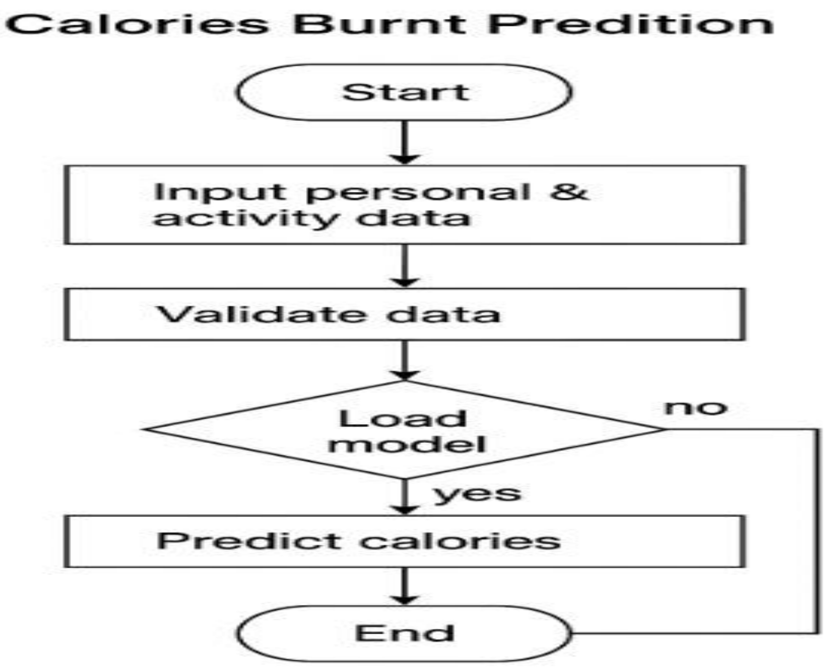


3.2.4. ACTIVITY DIAGRAM

Purpose: Visualizes the flow of activities for making a prediction.

Steps:

- Start
- Input personal & activity data
- Validate data
- Load model
- Predict calories
- Display result
- End



CHAPTER 4 IMPLEMENTATION

4.1 TECHNOLOGY DESCRIPTION AND TRAINING PROCESS

The Calories Burnt Prediction System is a machine learning-based application that estimates the amount of calories burnt based on its features such age, gender, height, weight, duration, body temperature and heart rate This project aims to provide an intelligent solution for predicting the market value of a calories without manual intervention, helping users make informed decisions. The XG Boost Regression(XGB) algorithm is used for building the predictive model due to its simplicity and effectiveness in regression tasks. The system is capable of learning from historical user data and producing accurate calories burnt predictions for user.

Technology Description

The system has been developed using the following technologies:

- Programming Language: Python
- Libraries and Frameworks:
- pandas: Data manipulation and analysis ○
- numpy: Numerical computations ○
- scikit-learn: Machine learning model building and evaluation
- matplotlib / seaborn: Data visualization
- Machine Learning Algorithm: XGBoost Regression
- Model Evaluation Metrics:
    - Adjusted R^2 Score ○
    - Mean Squared Error (MSE)
- Development Environment: Jupyter Notebook
- Data Storage: CSV file
- Optional Tools: Flask for deployment

Dataset Collection

The dataset consists of historical user listings including attributes such as:

- Gender
- Age
- Height
- Weight
- Duration
- Body temperature

- Heart rate
- Calories (target variable)

Data Preprocessing

Before training the model, the dataset undergoes preprocessing:

- Handling of missing values using imputation methods (e.g., forward fill)
- Encoding categorical variables using techniques like Label Encoding .
- Normalization or standardization of numerical attributes for uniform scaling using Standard Scaler.

Data Splitting

The data is split into training and testing sets in an 80:20 ratio to ensure the model is evaluated on unseen data.

Model Training

The XGBoost regression model is trained using the training dataset. Which gets more accuracy.

Evaluation

The model is evaluated using metrics such as:

- Adjusted R^2 Score: Measures how well the model explains the variability of the data.
- Mean Squared Error (MSE): Measures the average squared difference between actual and predicted values.

PSEUDO CODE:

Start

1. Import Libraries

- Import pandas as pd -
- Import numpy as np
- Import required modules from sklearn:
    - o LabelEncoder
    - o train_test_split
    - o XGBoostRegressor
    - o Evaluation metrics: r2_score, mean_squared_error

2. Load and Inspect Dataset

- Read CSV file: execrise.csv' into DataFrame (df)
- Display dataset information using df.info()
- Print number of unique values for selected features to understand data diversity

3. Data Cleaning and Preprocessing

- Remove ' ft' from 'Height' column and convert it to cm

- Identify all columns with 'object' (categorical) data types
- Apply LabelEncoder to convert categorical columns to numeric format

4. Feature Selection and Data Splitting
- Define input features (X) and target variable (y)
- Split the data into training and test sets using train_test_split

5. Model Training
- Work with different models such as Linear Regression, Decision Tree, SVM, XGBoost.
- Initialize XGBoost model with desired parameters .
- Repeat the working for all the selected models.
- Train the model using training data (X_train, y_train)

6. Model Prediction and Evaluation
- Predict calories using the trained model (y_pred = model.predict(X_test))
- Calculate evaluation metrics:
- R^2 Score
- Mean Squared Error (MSE)
- Print evaluation results

7. Conclusion
- Summarize model performance and findings
- Suggest possible improvements such as trying other algorithms or tuning hyper parameters

End

CHAPTER 5 RESULTS

Linear Regresssion Model

- R^2 0,95
- MSE 216,15

Decision Tree Model

- R^2 0,92
- MSE 321,89

Random Forest Model

- R^2 0,95
- MSE 188,40

XGBoost

- R^2 0,96
- MSE 166,75

Fig: Performance Evaluation Metrics

By observing the performance evaluation metrics, we can clearly evaluate the working of different models on the data in the given dataset.

* Evaluating using the Mean-Squared Error (Least MSE value implies a best fit model):

Sorted Values: **XGBoost < Linear Regression <=Random Forest < Decision Tree.**

Order of Best Fit by MSE: **XGBoost > Linear >=Random Forest> Decision Tree**

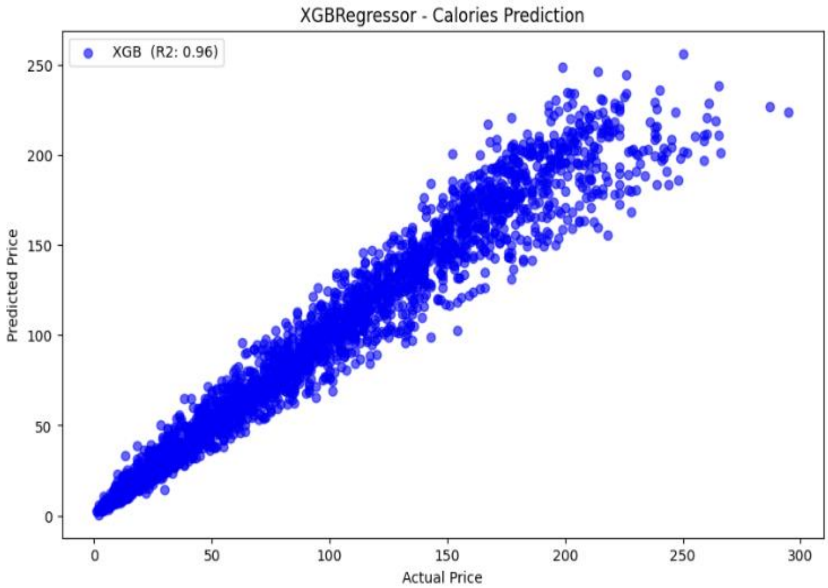
*Evaluating using the R-Squared Adjustment Factor (Higher R-squared value implies a best fit model):

Sorted Values: **XGBoost > Linear >=Random Forest> Decision Tree**

Order of Best Fit by R-squared Factor: **XGBoost > Linear >=Random Forest> Decision Tree**

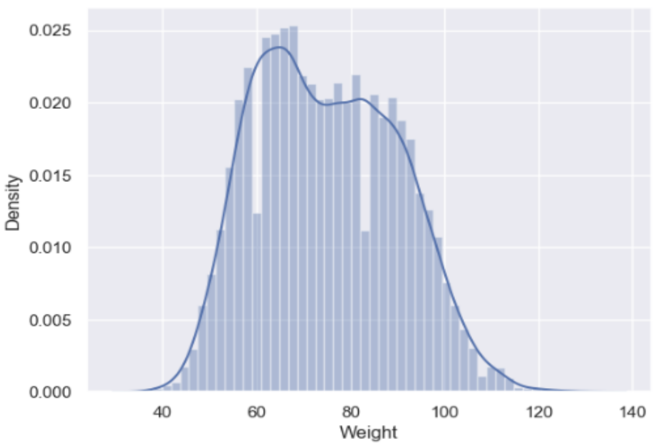
BEST FIT MODEL CHOSEN BY METRICS: **XGBoost**

XGB Regressor Plot

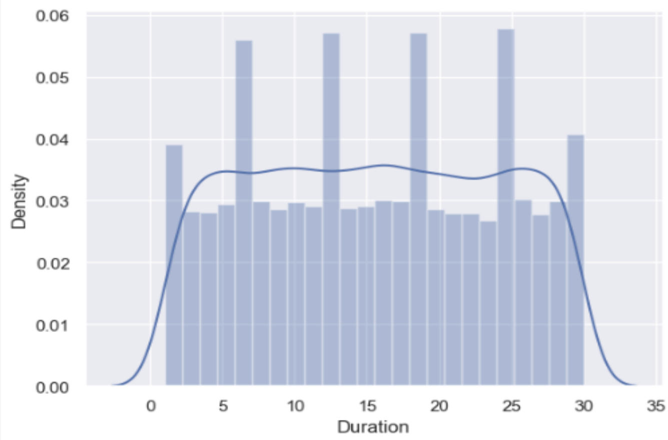


Heat Map

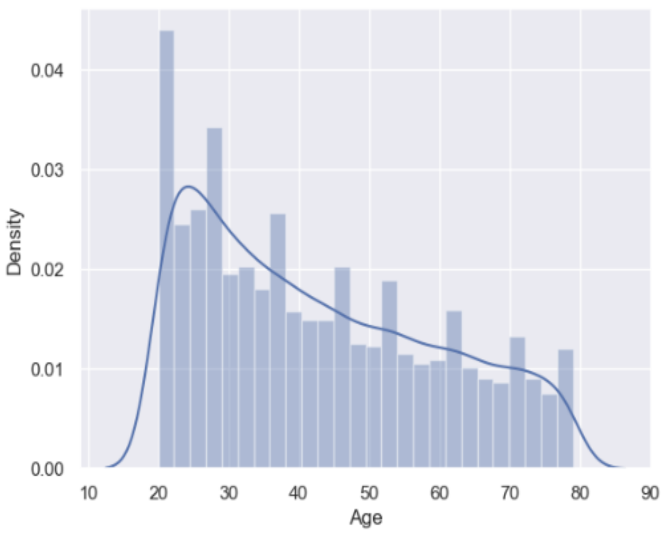
Weight



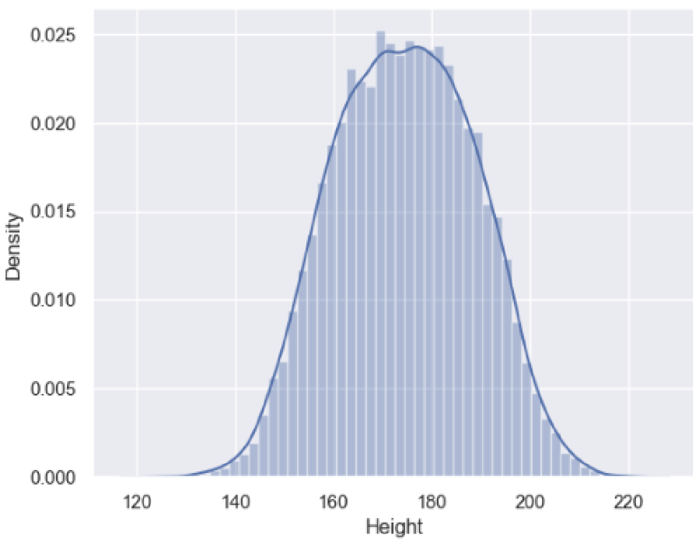
Duration



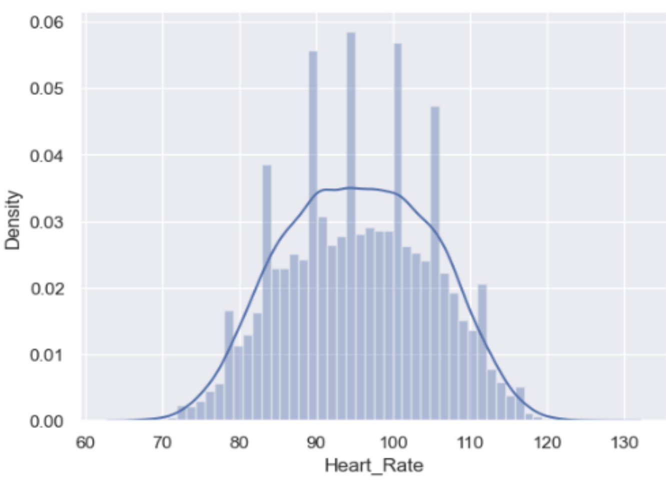
Age



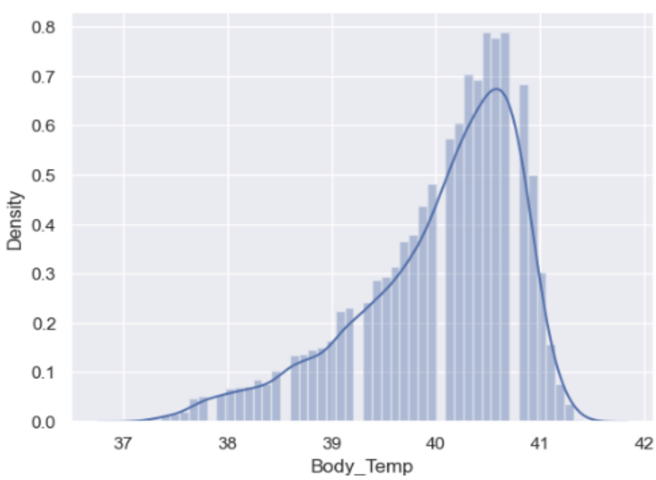
Height



Heart Rate



Body Temperature



CHAPTER 6 CONCLUSION

6.1 CONCLUSION

The Calories Burnt Prediction System has significant potential for future improvements and could play an even more pivotal role in the automotive industry. One of the key developments would be its integration with online platforms, such as calories prediction websites, online calculation calories, and e-commerce platforms. By enabling real-time calories estimates, users can instantly receive accurate results when listing their details. This would streamline the process for users

This research aimed to recognize the number of calories our body burns, which depends on several factors such as age, gender, weight, height, body temperature, duration, and heart rate. It is important to understand the number of calories we eat to stay fit and healthy. Calories burnt can be predicted from different regression algorithms such as Linear regression, XG boost regression, Ada boost regression, Decision tree regression, SVM, and Random forest regression. Out of these regression algorithms, Extreme Gradient Boosting (XG boost) regression gives the best accurate result. The MAE(Mean Absolute Error) value of the XG boost is 1.48 which is a good value. It means the errors are quite low. So, therefore, XG boost regression algorithm is the optimal algorithm for the calories burnt prediction so far.

Furthermore, the development of a mobile application would make the system accessible on-the-go. Users input details through their smartphones, receiving amount of calories burnt. The analysis of this model is done to find the best algorithm for predicting the calories burnt during exercise from factors such as age, height, weight, body temperature, gender, heart rate, and duration of exercise. The algorithm which provides the least mean absolute error is considered as best, this study applies various machine learning models over the dataset to find the least value of Mae, according to these results XGBoost regression is best for solving this problem with a Mae value of 1.48. And the highest Mae value is of support vector regression

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6.2 FUTURE SCOPE

The Calories Burnt Prediction System has a very great significant potential for future enhancements and broader applications. One of the primary areas for improvement is the integration with online platforms, such as calories resale websites, where users can obtain real-time burnt estimates while doing exercise. By incorporating real-time data sources, such as APIs from automotive marketplaces and calories, the system can remain continuously updated, ensuring that predictions reflect the latest burn calories trends and fluctuations. Additionally, the use of advanced machine learning algorithms such as Random Forest, Gradient Boosting, or deep learning techniques (like neural networks) can be explored to further improve accuracy, especially when dealing with complex, non-linear relationships between user details and calories.

Another promising extension is the inclusion of image-based predictions using computer vision techniques, where the system could analyze person images to assess external condition and factor it into the calories estimation, providing a more comprehensive evaluation of the calories. Furthermore, a mobile application version of the system could make it more accessible to users, allowing them to check calories on-the-go, whether they're at a calories in person.

The future of calories burnt prediction is evolving rapidly with advancements in AI, wearable technology, and personalized health analytics. Here's a detailed look at the key developments. Researchers are exploring deep learning techniques like XGBoost, Random Forest, and Neural Networks to enhance prediction accuracy.Models are trained on large datasets containing biometric data such as heart rate, body temperature, and activity duration.AI-driven calorie prediction is expected to achieve near-perfect accuracy, reducing errors in fitness tracking.Smartwatches and fitness bands will seamlessly track calorie expenditure using real-time biometric data.Future wearables may incorporate advanced sensors to measure oxygen consumption, metabolic rate, and muscle activity.AI-powered wearables will provide instant feedback, helping users optimize their workouts.

AI-driven fitness coaching will tailor workouts based on individual metabolism and activity patterns.Predictive analytics will forecast calorie needs based on lifestyle, stress levels, and sleep patterns, optimizing nutrition and exercise plans.AI will recommend personalized diet plans based on calorie expenditure and fitness goals.Fitness apps will sync with diet trackers, medical records, and AI assistants for holistic health monitoring.AI-powered platforms will analyze user habits and suggest optimal exercise routines.Future applications may integrate virtual reality workouts for immersive fitness experiences. AI will forecast calorie needs based on age, weight, activity type, and environmental factors.Predictive models will help prevent obesity and metabolic disorders by offering early intervention strategies.AI-driven health monitoring systems will assist in medical diagnostics and rehabilitation programs.

6.3 REFERENCES

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Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems
2. **Problem analysis:** identify, formulate, review research literature, and analyse complex engineering problem reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and designsystemcomponentsorprocessesthatmeetthespecifiedneedswithappropriateconsideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-hased knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:**Applyethicalprinciplesandcommittoprofessionalethicsandresponsibilitiesandnorms of the engineering practice
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs):

Engineering students will also be able to

1. Process, interpret the real-world data to formulate the model for predicting and forecasting.
2. Apply machine learning techniques to design and develop automated systems to solve real world problems.

PROJECT PROFORMA

Classification of Project	Application	Product	Research	Review

Note: Tick the appropriate box.

Project Outcomes	
Course Outcome (CO1)	Acquire technical competence in the specific domain during the training.
Course Outcome (CO2)	Identify the problem statement based on the requirements of the industry.
Course Outcome (CO3)	Adapt project management skills on par with industrial standards.
Course Outcome (CO4)	Develop a system model to obtain solution and generate a report.